PICTURED KEY TO SOME ALGAE OF SOUTHERN AUSTRALIA: RED ALGAE WITH NARROW BRANCHES. 3rd EDITION

Red Algae. With some 800 species, many of which are endemic (found nowhere else), southern Australia is a major centre of diversity for red algae. Classification is based on detailed reproductive features. Many species unrelated reproductively have similar vegetative form or shape, making identification very difficult if the technical systematic literature is used.

This key Fortunately, we can use this apparent problem to advantage - common shapes or morphologies will allow you to sort ***some*** algae directly into the level of Genus or Family and so shortcut a systematic search through intricate and often unavailable reproductive features. The pictured key below uses this ***artificial*** way of starting the search for a name. It's designed to get you to a possible major group in a hurry. Then you can proceed to the appropriate fact sheets to verify identifications.

Scale: the coin used as a scale is 24 mm or almost 1" wide. Microscope images of algae are usually blue stained.

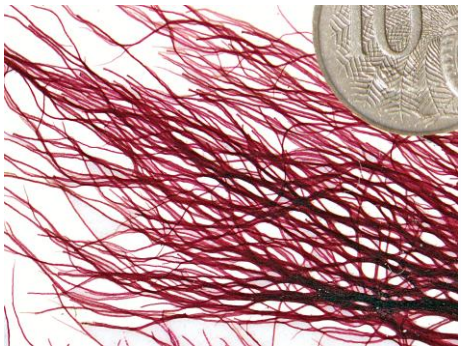
This key is ***restricted*** to algae with

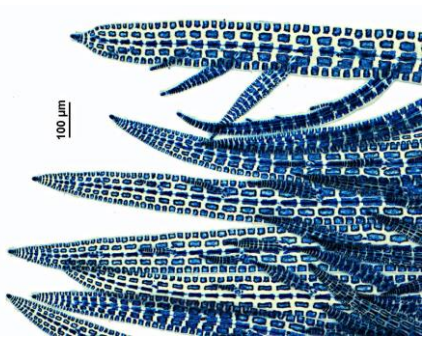
- branches ≤ 4 mm wide
- ***cylindrical*** (terete) branches, circular in cross section, ***or*** those with narrow, ***slightly compressed*** branches, ovoid in cross section
- ***forked, radial*** or ***irregular*** branching patterns

and ***excludes***:-

- species with a structure based on a single row of naked cells − the uniseriate and filamentous (thread-like) algae. (Figs 1, 2). These are covered in the "Pictured Key to some common filamentous red algae of southern Australia: Master Key".
- those with limey or calcified, inflexible outer coatings that may be stony or have jointed branches such as *Jania* (Figs 3, 4). See "Pictured Key to some common Coralline red algae of southern Australia"
- those with ***feathery*** or "***fishbone***" (pinnate) branching patterns with *broad* axes. (Figs 5-7). See "Pictured Key to feathery, flat-branched red algae"
- those where branches are pinched into sections or segments (see Fig. 8). These are found in "Southern Australian Groups at a glance: bead-like red algae"

Unavoidably, many steps in the key require microscope investigation, including cross sections of branches.

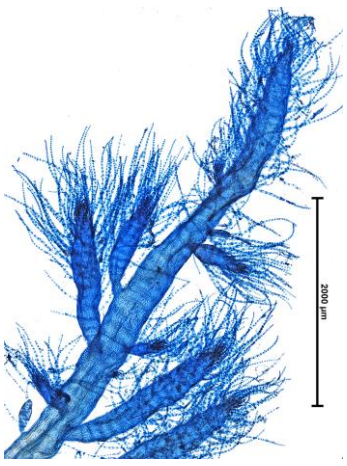




Figs.1, 2: *Platysiphonia delicata*. with filamentous construction, unfortunately only visible under the microscope; *excluded* from this key. For related groups, see "Pictured Key to some common filamentous red algae of southern Australia: Master Key"

Fig. 3: *Jania verrucosa* with limey, jointed branches, *excluded* from this key. For similar species, see "Pictured Key to some common Coralline Red Algae of southern Australia"

Fig. 4: *Jania micrarthrodia* , enlarged to show jointed branches, *excluded* from this key. For similar species, see "Pictured Key to some common Coralline Red Algae of southern Australia"



Figs 5, 6: *Spyridia squalida*; with feathery branching, the filamentous construction only visible under the microscope, and *excluded* in this key. For related groups see "Pictured Key to filamentous red algae"

Fig. 7: *Grateloupia subpectinata* with feathery branching. For related groups see "Pictured Key to feathery, flat-branched red algae"

Fig. 8: *Rhabdonia clavigera* with jointed branching. For related groups see "Southern Australian Groups at a glance: bead-like red algae"

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PICTURED KEY

1a. plants slimy ***or*** with a limy, dust-like coating (effervescing in acid), ***or*** with the ***surface faintly fuzzy***; branches worm-like. Tissue squashes show a core of microscopic, colourless, twisted threads and surface (cortex) layers of ***loose bunches*** of small, outwardly-pointing cells. Figs 9-12.

See "Pictured Key to some common Red Algae of southern Australia: Order: Nemaliales"

1b. plants not slimy, although some may have smooth surfaces; branches soft, leathery, gelatinous or gristly, cylindrical (terete) or flattened, a few coated in lime. If microscopic threads are present in tissue squashes, then cells of the surface tissues (cortex) are ***tightly*** held together …….. 2.

2a. cores seen in cross section consist entirely or partly of fine, microscopic threads …… 3.

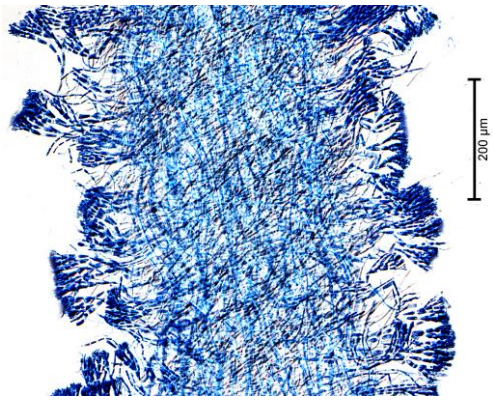
2b. cores in cross section contain mainly equal-sided cells ..... 20.

3a. branches ***hollow*** except where short side branches, narrow at their base, arise at right angles to main branches (axes); surface layers often have small, bright gland cells amongst larger cells ..... 4.

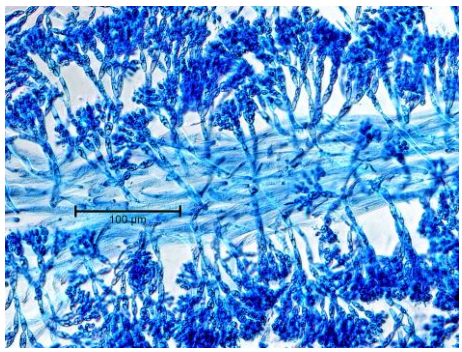
3b. branches generally solid, core threads dense ***or*** well-spaced, surface layers with or without glands …….. 5.

4a. plants form tangled turfs in the upper sub-tidal. Spore patches, viewed microscopically, point inwards. Figs 13-16. .... *Lomentaria monochlamydea* Family: Lomentariaceae (can be confused with *Gigartina brachiata*; see step 9a below) .

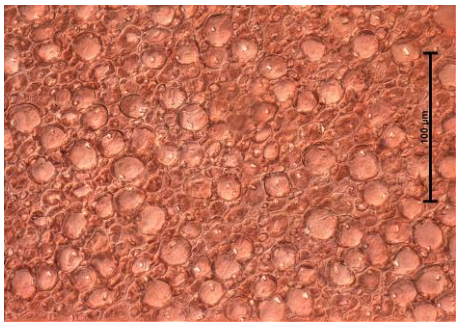
4b. plants not forming tangled turfs. Figs 17, 18. .....see Fact Sheets for *Lomentaria* spp and *Semnocarpa* spp



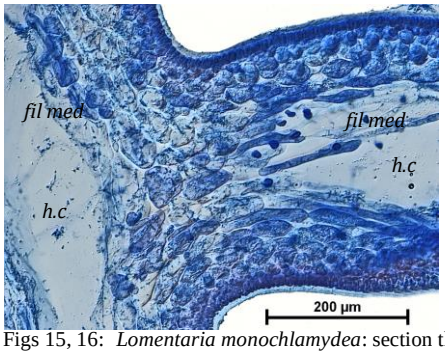
Figs 9, 10: *Helminthocladia dotyi*, pressed specimens and a tissue squash showing the wide core of fine threads and surface layers of loose bunches of outwardly pointing cells, some displaced

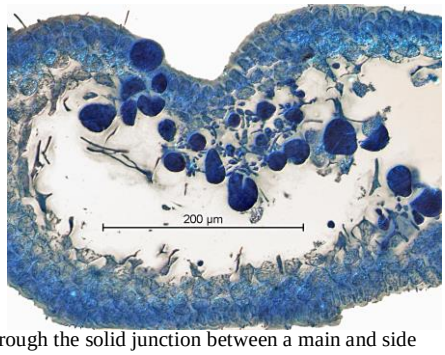


Figs 11, 12: *Liagora harveyana*, pressed specimens with characteristic chalky surface, and a tissue squash showing a narrow core of fine threads and surface layers of loose bunches of outwardly pointing cells, (the limey or chalky deposits dissolved away during the staining process)



Figs 13, 14: *Lomentaria monochlamydea*: turf on the West Beach, Adelaide marina wall, and microscope view of surface cells





Figs 15, 16: *Lomentaria monochlamydea*: section through the solid junction between a main and side branch, hollow core (*h.c*), threads (*fil med*); section through a spore patch, spore clusters pointing inwards

Fig.17: *Lomentaria australis*

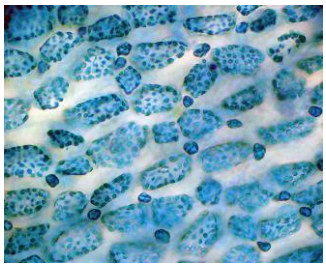


Fig.18: *Lomentaria australis*, microscope, stained preparation of dark gland cells on the edges of surface cells

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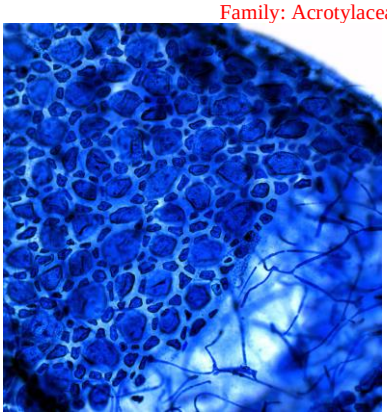
5a. surface microscopic views show rings (rosettes) of small cells around larger ones ....……..…….. 6.

5b. no cell rosettes, although bunches of small cells below surface cells may be visible ..... 7.

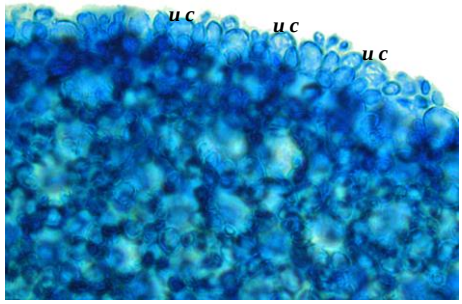
6a. plants red, branching forked (dichotomous). Rosette cells surround balloon-like (utriculate) cells. Figs 19, 20.
..... *Scinaia australis*
Family: Galaxauraceae in the Flora, recently merged with Scinaiaceae

6b. plants dark red, drying almost black, branching radial, wiry, branches at base are tangled . Balloon-shaped cells absent. Figs 21-23.
..... *Antrocentrum nigrescens*
Family: Acrotylaceae



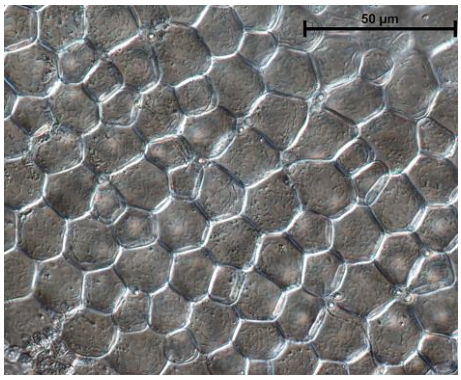
7a. plants soft, bunches of droplet-shaped cells terminating core threads may appear underneath 6-sided, colourless surface cells. (Branches of some plants may be pinched into segments). Figs 24-28.
..... *Scinaia* 4 remaining spp
See individual species fact sheets
Family: Galaxauraceae in the Flora, recently upgraded to Scinaiaceae

7b. plants tougher, surface cells not as above …….. 8.



Figs 19, 20: *Scinaia australis*. Whole plant and oblique microscopic surface view of rosettes and some protruding utriculate cells (*u c)*

Figs 21-23: *Antrocentrum nigrescens*.
Left: oblique view of cell rosettes and underlying core threads.
Centre: plant tips, showing wiry branching.
Right: tangled plant base.



Figs 24, 25: *Scinaia tsinglanensis*. Whole plant and surface microscopic view of 6-sided cells

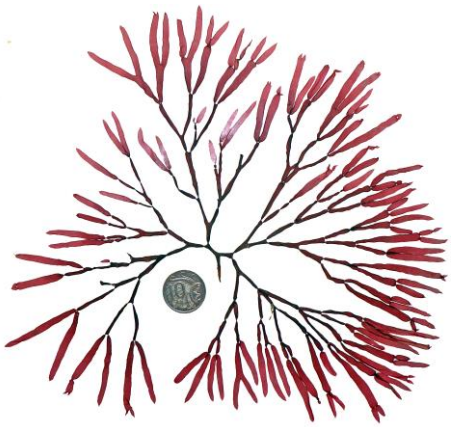
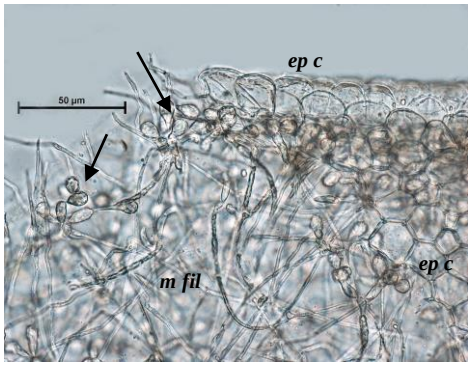
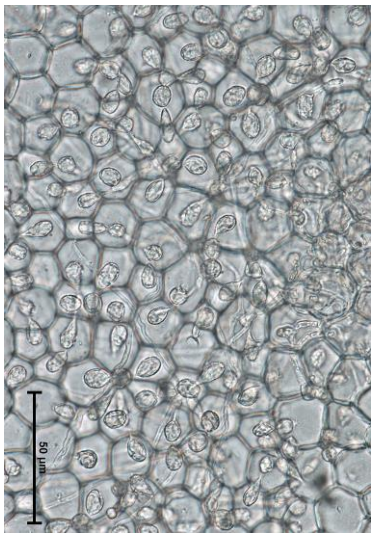


Fig. 26: *Scinaia arborealis*





Figs 27, 28: *Scinaia tsinglanensis*.
Oblique cross section showing colourless surface cells (*ep c*), core threads (*m fil*) some ending in droplet-shaped cells (arrowed), better seen in the microscopic surface view at right, where they have been focused through the overlying surface cells

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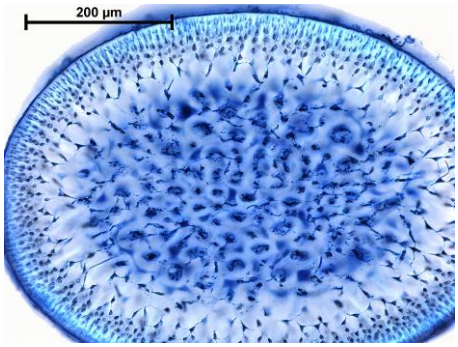
8a. plants grow in dense, tangled ***turfs*** in the lower intertidal/upper subtidal ..... 9.

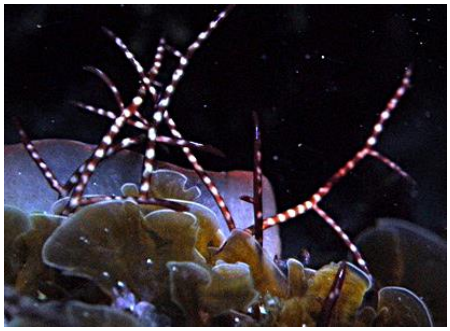
8b. plants not as above ..... 10.

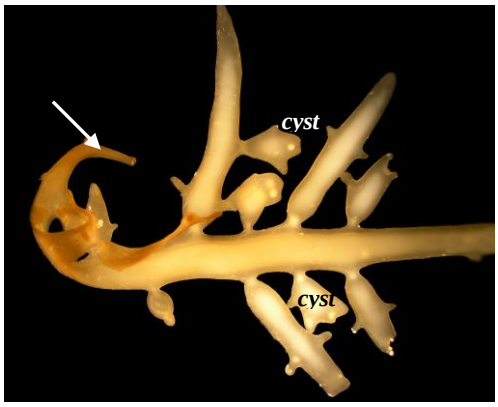
9a. branches cylindrical, tips pointed, side branches short, spreading, white-banded when fertile; cores wide, consist of threads. Figs 29-31. ..... *Gigartina brachiata*
Family: Gigartinaceae
(May grow intermingled with *Lomentaria monochlamydea*, see step #4a, above)

9b. Branches flattened, branching irregularly in 2 rows (pinnate), some branches curved at tips. Female structures (cystocarps) embedded in short, spiny side branches. Figs 32-34 ..... *Sarcothalia insidiosa*
Family: Gigartinaceae



Figs 29-31: *Gigartina brachiata*.
Above, left: tangled mat from the upper subtidal at West Beach, SA
Above, right: cross section, with wide core of branched threads
Below, right: detail of divergent side branches and fertile white bands in an underwater image of plants amongst a flat-bladed Brown alga. photo D. Muirhead





Figs 32-34: *Sarcothalia insidiosa*
Left: whole plant

Centre: detail of irregular branching and pointed branch ends

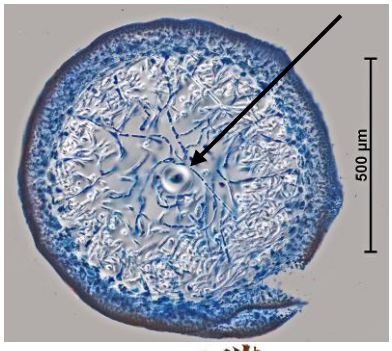
Right: curved branch tip (arrowed), female reproductive organs (***cyst***, cystocarps) in short side branches bearing spines

10a. cross sections show only fine threads in the cores of mature branches ..... 11.

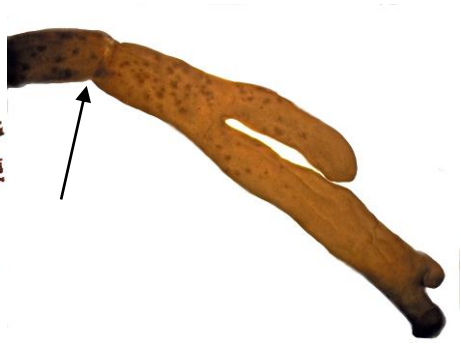
10b. cross sections of mature branches show fine core threads and, in addition, a prominent central thread (refer to the figure opposite) ..... 16.

11a. plants are flat-branched (complanate), fairly regularly forked (dichotomous) and tips usually rounded ..... 12.

11b. plants are radially or irregularly branched, tips usually pointed ..... 15.



Cross section of *Areschougia congesta*: core of fine, branched threads but also a central, bright, prominent thread (arrowed) in cross section



Figs 35, 36: *Adelophycus corneus*
Left: whole plant

Right: detail of branches with, embedded, scattered spores and a slight constriction (arrowed)

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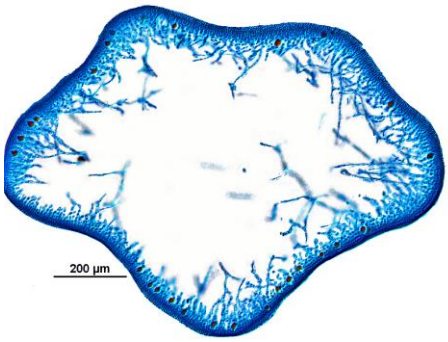
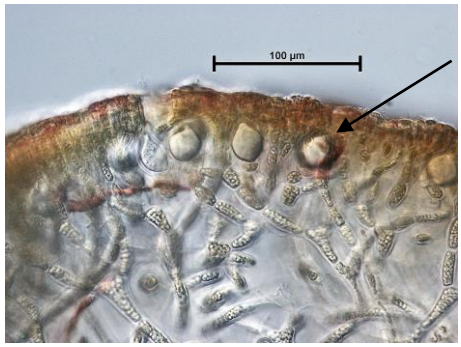
12a. branches wrinkle on drying, some have irregular constrictions; bright, microscopic ***gland cells*** are present in the outer layers (cortex), spores occur in scattered patches. Figs 35, 36 previous page, Figs 37, 38 this page
…….. *Adelophycus corneus*
Family: Nemastomataceae

12b. plants are leathery or soft, or almost slimy; bright, microscopic glands are ***absent***
..... 13.

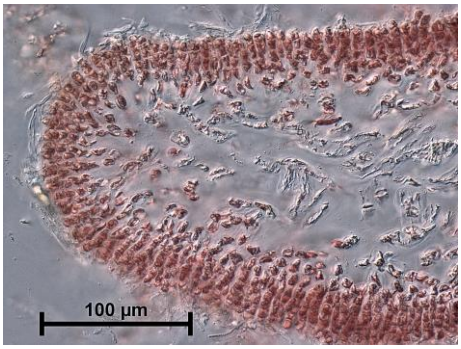




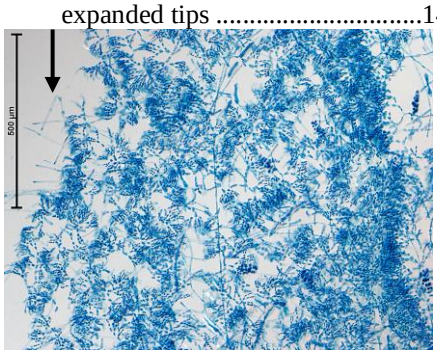
Figs 37, 38: *Adelophycus corneus*, cross section of a slightly wrinkled branch and detail of the cortex with bright gland cells (one arrowed)

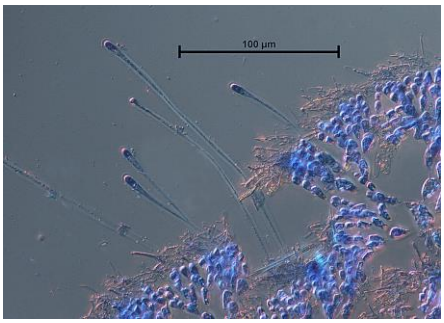
13a. sexual plants are small, 10-30 mm tall, and grow on the seagrass *Amphibolis*. Numerous microscopic surface hairs with slightly ***expanded tips*** are present. (An even smaller, inconspicuous, totally different-looking encrusting plant produces spores and completes the life cycle of this species.) Figs 39-43.
..... *Kraftia dichotoma*
Family: Dumontiaceae

13b. sexual and spore-producing plants are larger, grow on rock or other marine plants. Surface hairs are ***absent*** or if present do not have expanded tips .....14.



Figs 39, 40: *Kraftia dichotoma*
Left: cross section through a blade edge
Right: whole plant

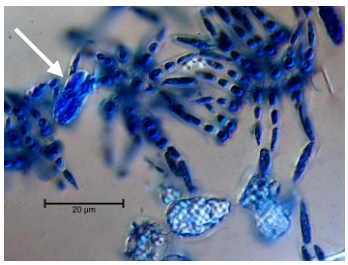


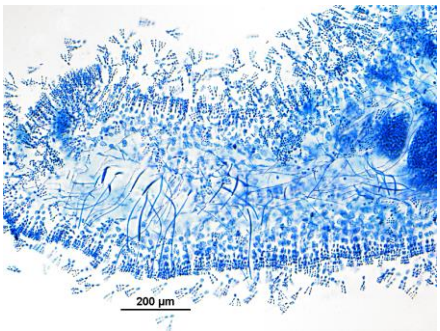


Figs 41-43: *Kraftia dichotoma*
Left: tissue squash, displaced surface hairs (arrowed)
Centre: detail of surface hairs
Right: sporangial plants on a sea-grass stem

14a. plants naturally soft but may dry firm, spores divided into a cross (cruciate) shape. Figs 44-47.
..... *Tsengia feredayae*
Family: Nemastomataceae

14b plants more gristly, spores divided into stacks of 4 (zonately) or into a cross shape (cruciately)
..... 15.





Figs 44-47: *Tsengia feredayae*
Below, far left: dried and hardened specimen
Above, left: fresh, softer specimen
Above, right: tissue squash. Inner core of loose threads, outermost layer of fan-shaped bunches of small cells
Immediately left: detail of outermost cells with one cruciately-divided spore (arrowed)

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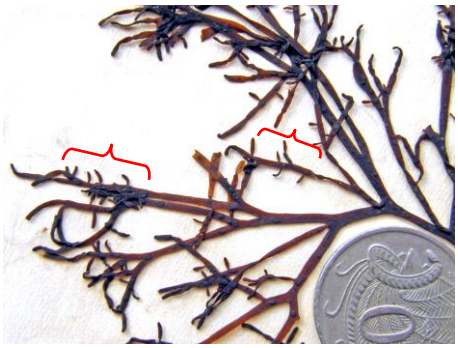
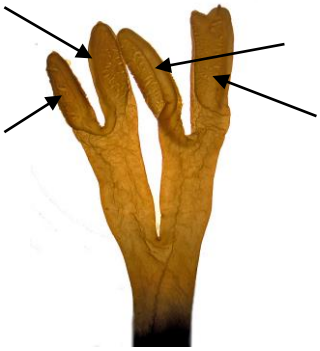
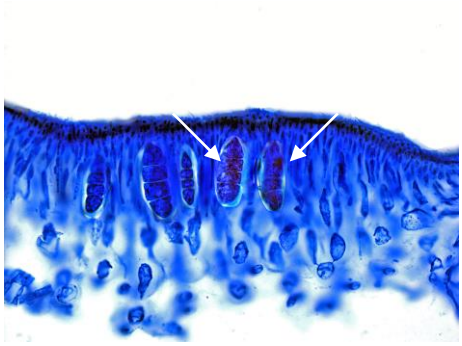
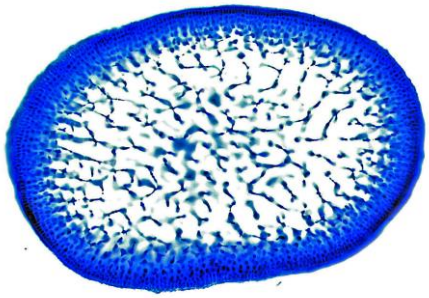
15a. spores in swollen "bags" (nemathecia) at branch tips, divided into stacks of 4 (zonate). Numerous extra side branches (adventitious branches) may arise in some plants. Figs 48-52.
…… *Acrotylus australis*
See also "Acrotylaceae at a glance

15b. spores not as above. Branching usually regularly forked. Spores formed in patches amongst hairs (= chains of small cells), divided in a cross-pattern (cruciate). Figs 53-58.
……. *Polyopes constrictus*
..... *P. tenuis*
Go to "Southern Australian Groups at a Glance: Halymeniaceae
(a third species, *P. tasmanicus* has numerous short, radial side branches around axes and so has been excluded)


Figs 48, 49: *Acrotylus australis*. Left: whole plant. Right: usual regular, flat-forked branching pattern.

Figs 50-52: *Acrotylus australis*.
Left: plant with extra (adventitious) branches (bracketted)
Centre: preserved (bleached) branch tips with spores in nemathecia (arrowed)
Right: cross section of outer layer, stacks of 4 spores (zonate sporangia, arrowed), bright gland cells ***absent***.



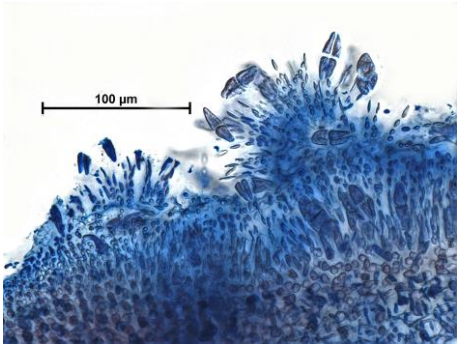
Figs 53-55: *Polyopes tenuis*.
Left: cross section

Centre: whole plant

Right: detail of branching pattern

Figs 56-58: *Polyopes constrictus*
Left: whole plant

Centre: detail of branching

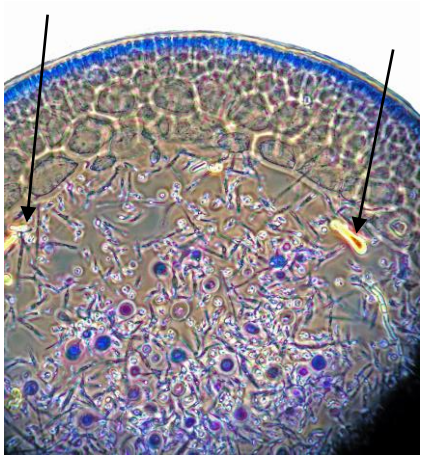


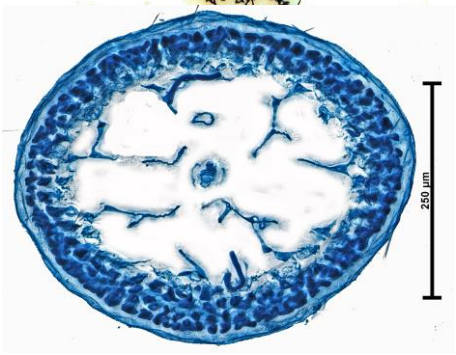
Right: cross section of spore patch. Some chains of cells and cruciately-divided spores extruded

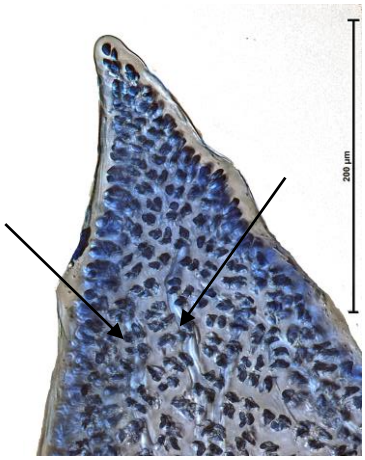
16a. ***single*** cells at tips. Cross sections of ***young*** branches have a single central thread, cores of mature branches have many thin threads, often also ***thick yellow threads***.
Figs 59-63.
…..…… *Rhabdonia coccinea*
Family: Areschougiaceae
Other *Rhabdonia* species are jointed

16b. ***numerous*** threads lead away from several, obscure tip-cells. Yellow threads ***absent***. Figs 64-69.
……..…… *Solieria* 2 spp
Go to "Southern Australian Groups at Glance: Areschougiaceae"

Figs 59, 60: *Rhabdonia coccinea*
Two plants with contrasting branching patterns



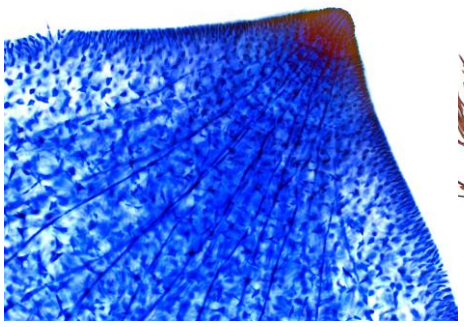




Figs 61-63: *Rhabdonia coccinea*,
Left: cross section ***mature*** branch, numerous core threads, bright, thick-walled yellow threads (arrowed)

Centre: cross section ***young*** branch central filament apparent

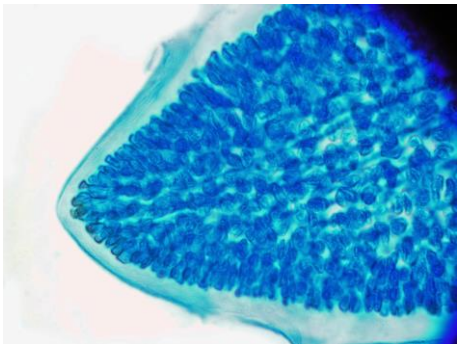
Right: single tip cell, bright, thick-walled yellow threads (arrowed)

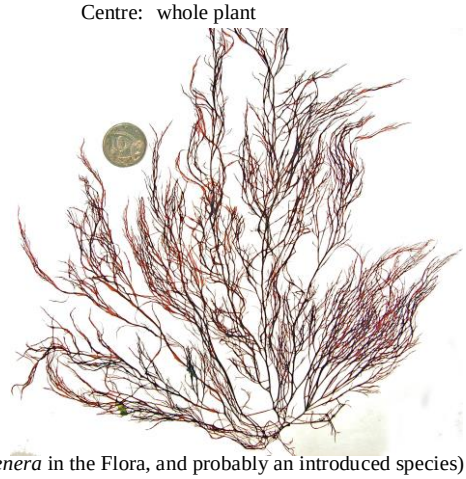


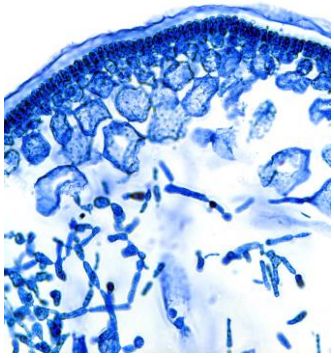
Figs 64-66: *Solieria robusta*,
Left: branch tip, many threads leading away from several tip cells, yellow threads ***absent***

Centre: whole plant

Right: fresh, soft cylindrical branches in detail





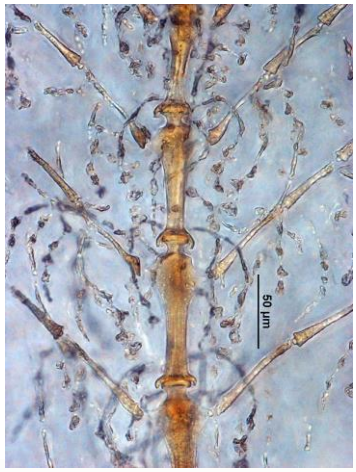


Figs 67-69: **Solieria filiformis* (previously *S. tenera* in the Flora, and probably an introduced species)
Left: branch tip
Centre: whole plant
Right: cross section

Baldock, R.N. (2020). Red algae with narrow branches 3rd edition. 20 pages. *Algae Revealed*. Adelaide: State Herbarium of South Australia.
flora.sa.gov.au/algae_revealed

17a. branches cylindrical or flattened, forked or with short side branches ***basally narrow***. In ***lengthwise*** sections or tissue squashes of ***young*** branches, ***2-4*** radiating threads arise from each cell of a prominent central thread. Figs 70-74.
..... *Nizymenia* 3 spp
(Includes 2 spp under *Stenocladia* in the Flora)
Go to "Southern Australian Groups at Glance: Nizymenia"

17b. in ***lengthwise sections*** or tissue squashes of ***young*** branches, a central large thread can be seen producing a ***single*** diverging thread from each of its cells. Later additional, numerous threads obliterate this pattern ..... 18.



Figs 70, 71: *Nizymenia conferta*, whole plant (above) and lengthwise view (right) of a dissected central thread with diverging pairs of threads from each of its cells

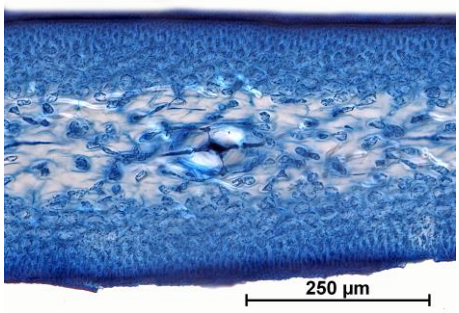
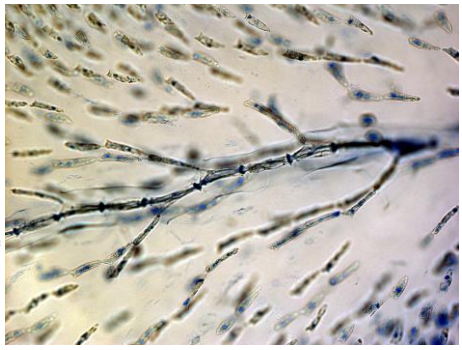


Fig. 72 (far Right): *Nizymenia furcata*,
Figs 73, 74: *Nizymenia conferta*
Centre: detail of side branches
Above: cross section; prominent central filament with 4 radiating arms

18a. plants dark red-brown, much-branched, forming ***dense mats***; branches cylindrical, upper ones ≤ 0.3 mm wide. Figs 75, 76.
..... *Melanema dumosa*
Go to "Southern Australian Groups at Glance Areschougiaceae"

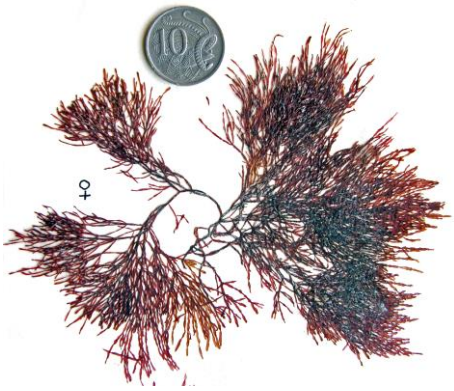
18b. plants dark- or light-red, main branches distinct, cylindrical to slightly flattened, 1-4 mm wide
..... 19.

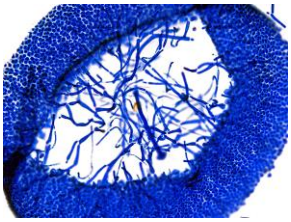


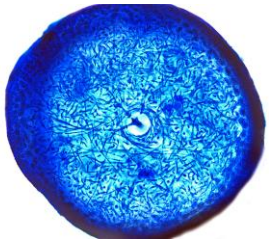
Figs 75, 76: *Melanema conferta*, turf and lengthwise view of a dissected central thread with a single thread emerging from each of its cells

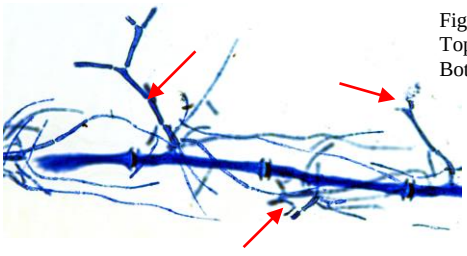
19a. young branches obscurely jointed into long segments (included in this key because although segments are present, they are difficult to ascertain); cores of young branches with sparse threads, later, threads are denser. Figs 77-81.
..... *Erythroclonium angustatum*
Family: Areschougiaceae

19b. not as above. Figs 82-92 (next page)
..... *Areschougia* 3 spp
Go to "Southern Australian Groups at Glance: Areschougiaceae"



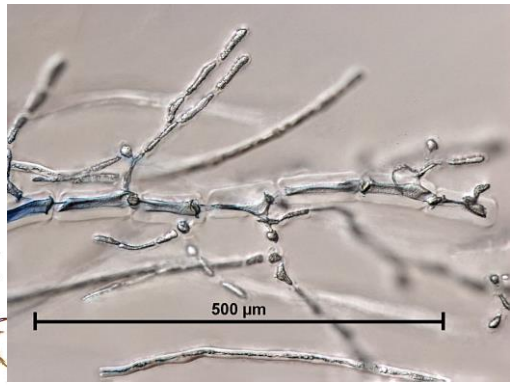


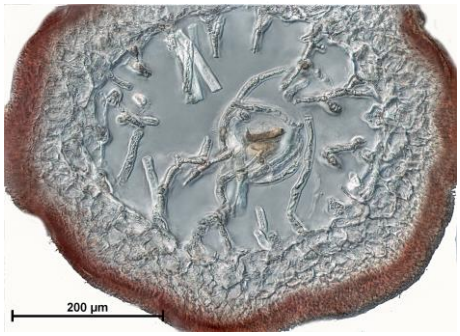


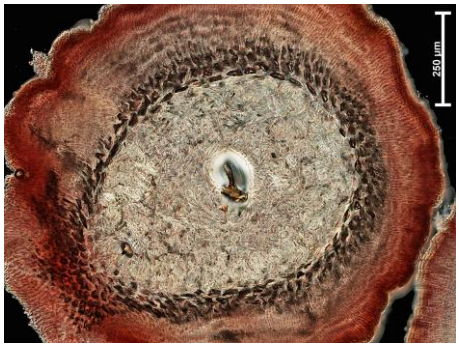


Figs 77-81: *Erythroclonium angustatum*
Top: whole plant and branching pattern
Bottom: microscopic features.
Far left: cross section, young branch
Centre: cross section , old branch
Right: core threads dissected from a branch showing single threads (arrowed) diverging from each cell of the large central thread

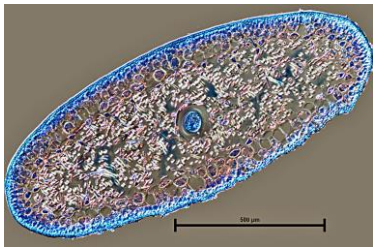
Figs 82, 83: *Areschougia congesta*
Right whole plant
Far Right lengthwise view of a dissected central thread with a single thread arising from each of its cells



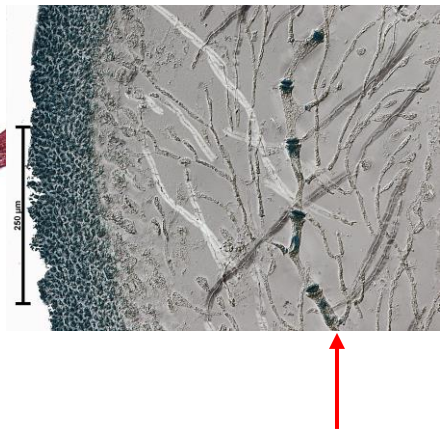




Figs 84-86: *Areschougia congesta*
Left: preserved (bleached) specimen showing ***radial*** branching and pointed tips
Centre: cross section of a young branch showing prominent central thread and core of loose threads
Right: cross section of an old, thickened branch showing the central thread still prominent



Figs 87-89: *Areschougia stuartii*.
Far Left: whole plant, ***many*** main branches (axes) arising from the base
Centre: detail of compressed ***flat-branched*** branches, ***1-2 mm broad***, pointed tips, ***short side branches***
Right: cross section of compressed branch, central thread prominent



Figs 90-92: *Areschougia ligulata*
Left: whole plant, ***single*** main branch (axis) basally
Centre: detail of compressed ***flat-branched*** branches about ***3 mm broad***,
Right: lengthwise section, thread prominent (arrowed)

Baldock, R.N. (2020). Red algae with narrow branches 3rd edition. 20 pages. *Algae Revealed*. Adelaide: State Herbarium of South Australia. flora.sa.gov.au/algae_revealed

from step #2b – here, cross sections show cores with at least a few equal-sided (parenchymatous) cells

20a. branching fine, delicate, plant tips seen under the microscope present a zig-zag pattern . Cross sections of young branches show a prominent central thread later wrapped in fine threads (rhizoids). Figs 93-96. ..... *Delisea hypneoides*
Family: Bonnemaissoneaceae
(The 3 other species in *Delisea* have distinctive herring-bone branching patterns. Although strictly growing from a thread-like construction and so belonging to the "Pictured key to some common filamentous red algae of southern Australia" that anatomy is often obscure in *D. hypneoides* and so this species is consequently included in this key)

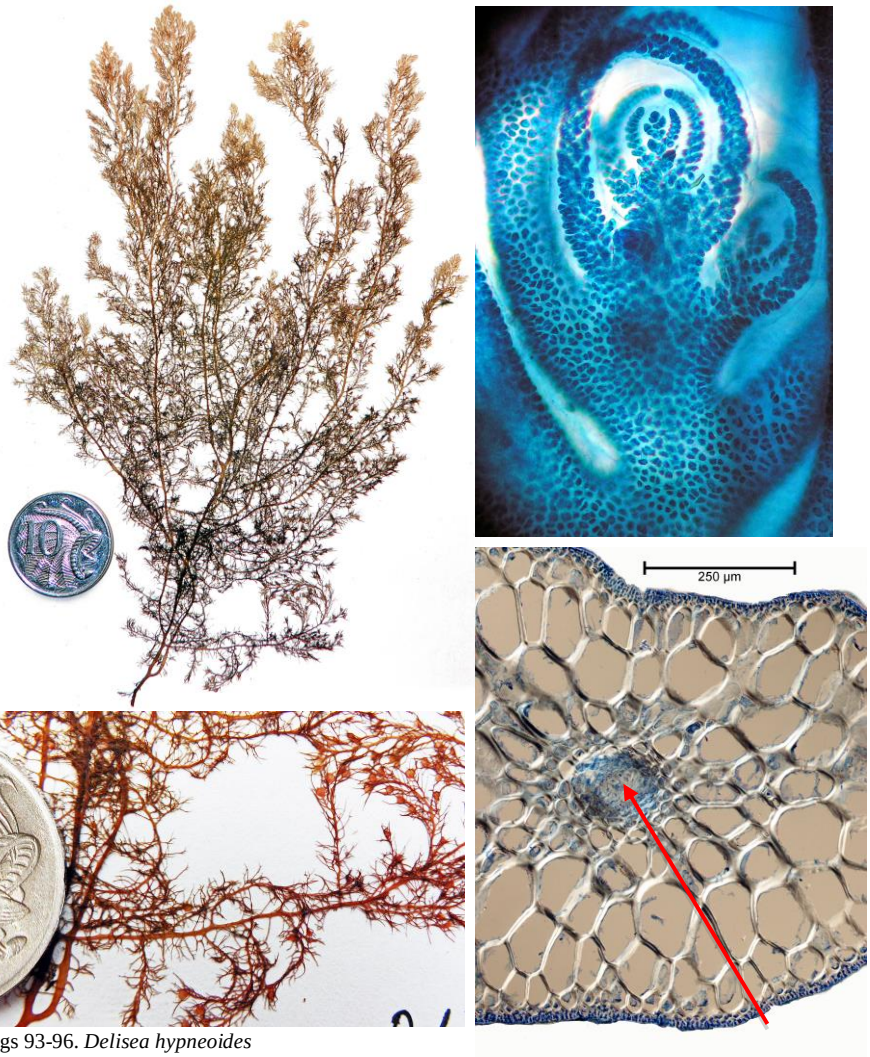
20b. branching not as above ..... 21.

21a. branch tips ***come to a point*** with a single tip cell, branches have a single, prominent, central thread ..... 22.

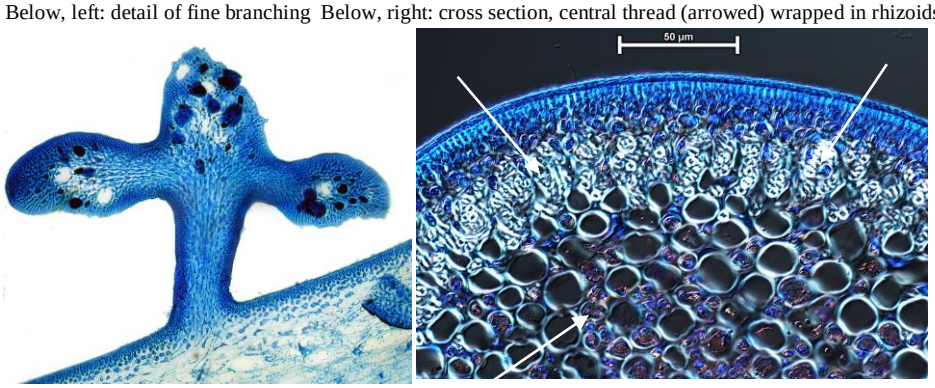
21b. branch tips ***rounded*** *or* ***dimpled***, with obscure single cells *or* many cells; branch cores with many cylindrical cells *or* fine threads ..... 28.

22a. plants form dense mats or turfs in the lower intertidal or in shallow water at reef edges, Branches cylindrical ***or*** compressed arise essentially in 2 rows. Cross sections show clusters of small ***thick-walled cells*** (rhizines). Branches bearing spores are ***beaked*** or ***cross-shaped***. Figs 97-101.
Gelidium crinale, G. pusillum
Capreolia implexa
(successfully separated only on reproductive features)
Go to "Southern Australian Groups at a glance: Gelidiaceae

22b. not as above ..... 23.



Figs 93-96. *Delisea hypneoides*
Above, left: whole plant. Above, right: highly magnifies view of the plant apex, zig-zag branching pattern
Below, left: detail of fine branching Below, right: cross section, central thread (arrowed) wrapped in rhizoids



Figs 97, 98: *Gelidium*
Left: microscopic view of a cross-shaped side branch bearing spores
Right: partial cross section, packets of thick-walled rhizines (arrowed)

Fig. 99: *Capreolia implexa,*

Fig. 100: *Gelidium pusillum*

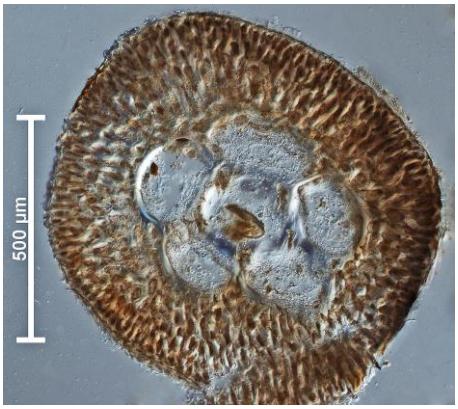
Fig. 101: *Gelidium crinale*

23a. plants dark-red, often almost black when dry, tree-shaped, with 1-several central main branches (axes), sometimes thick and trunk-like; wiry or fine cylindrical side branches …….. 24.

23b. not as above ..... 27.

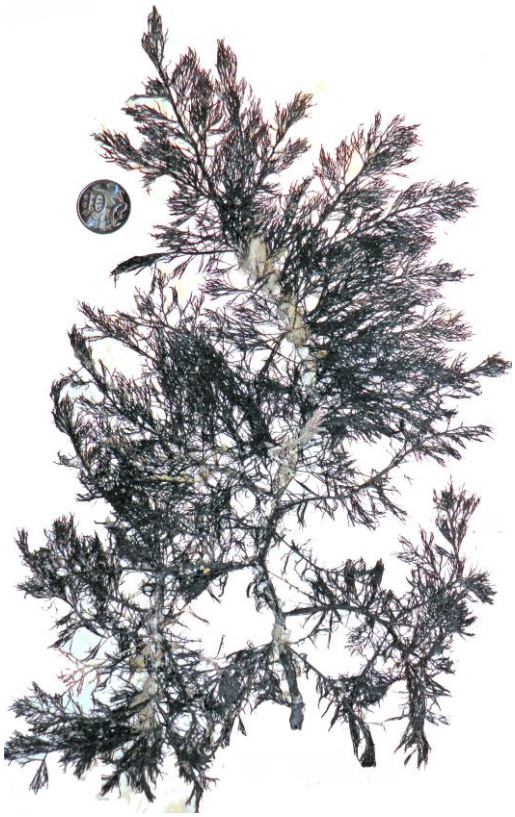
24a. plants often large (300 mm tall), ultimate branches thin, with internal cells producing a "brick-wall" pattern. Old axes > 10 mm wide, covered in sponge or encrusting animals. Branched hairs (trichoblasts) may protrude from pointed tips. Cross sections show a ring of 5 cells (pericentrals) ***sharply defined*** from small outer cells. Figs 102-105.
…….. *Cladurus elatus*
Family: Rhodomelaceae, Tribe: Chondrieae

24b. ultimate branches without a brick-like pattern. Trichoblasts present or absent ……. 25.



25a. side branches short, in ***clusters***, arising from the one level (umbellate). Figs 106-109.
..... *Heterocladia umbellifera*
Family: Rhodomelaceae
Tribe: Heterocladieae

25b. side branches short, long and wiry or spine-like, radially or irregularly arranged ..... 26.



Figs 102-104: *Cladurus elatus*
Left: cross section, 5 sharply defined pericentral cells
Above: whole plant, sponge on the upper axis
Right: microscopic view of a pointed tip with emergent trichoblast

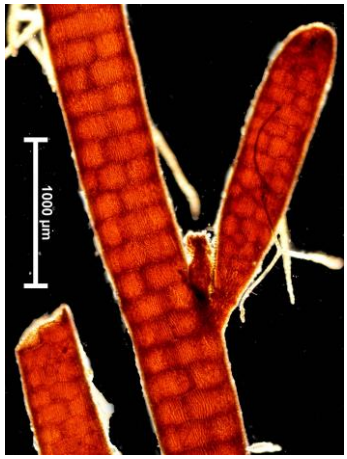
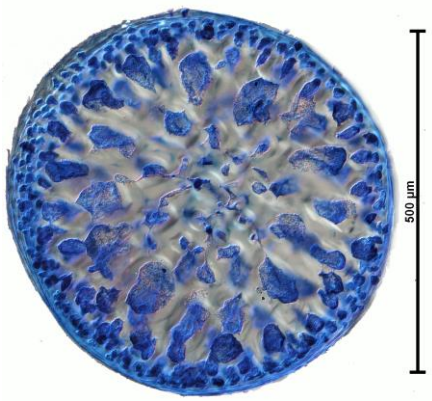


Fig. 105 *Cladurus elatus*
back-lit microscopic view of the "brick-wall" cell pattern of internal cells showing through surface cells



Figs 106-109: *Heterocladia umbellifera*
Above, left: whole plant.
Above, right: detail of umbellate side branches
Below, left: plant with dense side branches obscuring the umbellate branching pattern.
Below right: cross section of a young branch

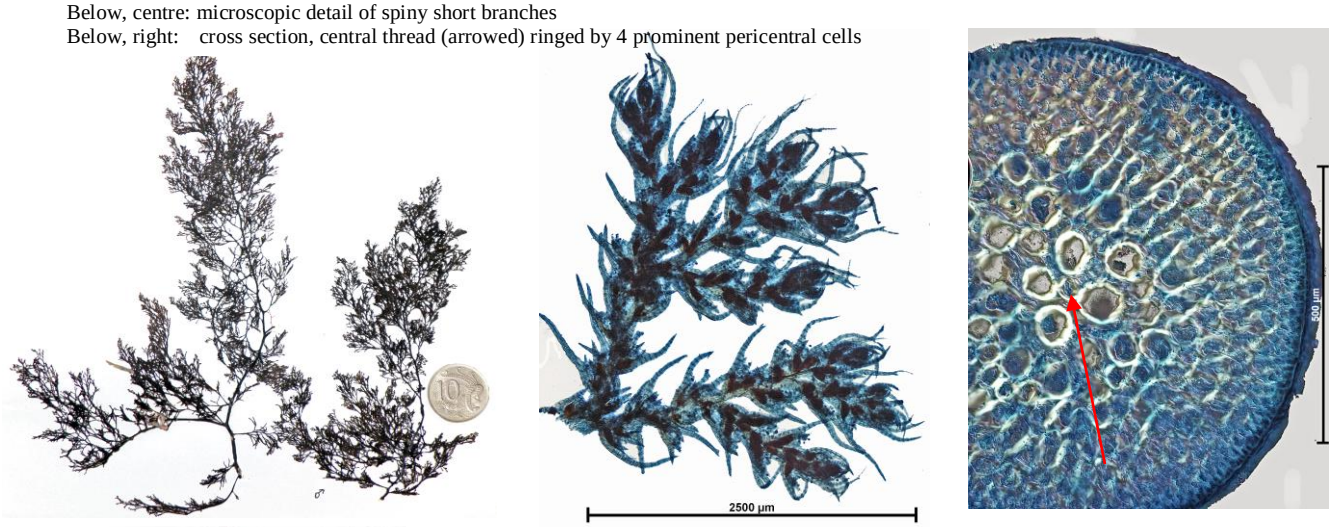
26a. several main wiry main branches (axes) are present. Cross sections show a small central thread ringed by 4 (pericentral) cells. Figs 110-114
..... ***denuded*** plants of
Chiracanthia arborea
Family: Rhodomelaceae
Tribe: Polysiphonieae

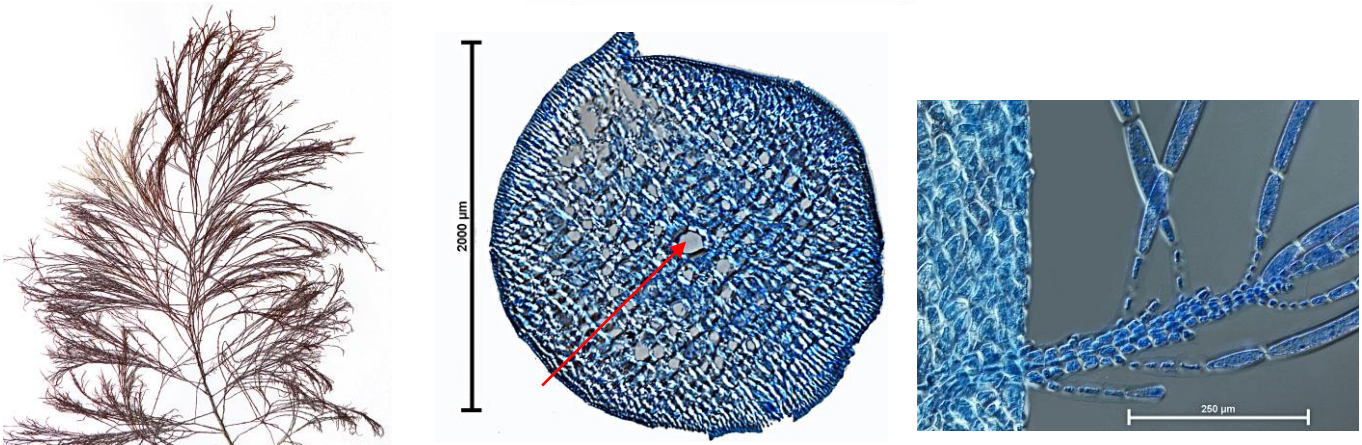
Plants are often in this denuded condition. When not, hair tufts (trichoblasts) and spine-like short branches are present and the plant looks significantly different (see opposite) and can be identified using the "filamentous red algae key"

26b the plant is tree-like with a single main branch (axis). Cross sections have only the central filament prominent. Figs 115-117.
..... *Gonatogenia subulata*
Family: Rhodomelaceae
Tribe: Lophothalieae

These plants are often also denuded, lacking microscopic hair tufts (trichoblasts) that have characteristic multicellular bases. Similarly, they can also be identified using the "filamentous red algae key"

Figs 110-114: *Chiracanthia arborea*
Right: denuded specimen
Far right: partially denuded specimen
Below, left: specimen with intact side branches
Below, centre: microscopic detail of spiny short branches
Below, right: cross section, central thread (arrowed) ringed by 4 prominent pericentral cells





Figs 115-117: *Gonatogenia subulata*
Left: denuded, tree-like plant. Centre: cross section with prominent central thread (arrowed)
Right: remnant trichoblast from a branch that has not been denuded

27a. microscopic hair tufts (trichoblasts) present, although easily shed. Internal cells (pericentral cells) show through surface layers and form visible blocks along young branches; cross sections of young branches show a prominent central thread surrounded by ***5*** equal-sized (pericentral) cells, some with bright crescents or cap-shaped ***wall thickenings***. Figs 118-123.

..... *Chondria* spp (in part)

See "Pictured Keys: *Chondria* and *Husseya* Family: Rhodomelaceae, Tribe: Chondrieae

27b. hair tufts ***absent***, wall thickenings ***absent***; cross sections show a prominent central thread surrounded by large oval cells of ***mixed sizes***. Figs 124-127.

..... *Hypnea* spp

See "Southern Australian Groups at Glance: Hypneaceae"

Fig. 118: *Chondria bulbosa*

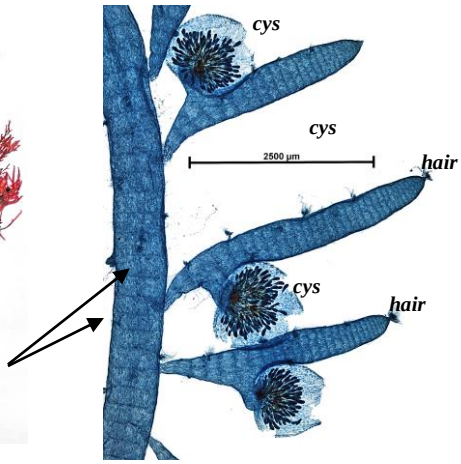


Fig. 119: *Chondria bulbosa*, pointed tips, hair tufts (*hair*), blocks of cells visible internally (arrowed), female structures (cystocarps, *cys*)

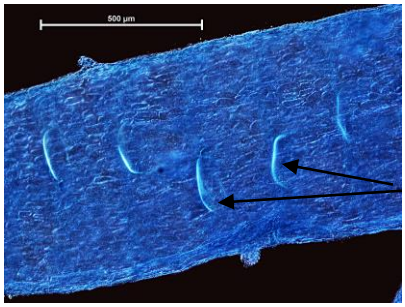


Fig. 120: *Chondria bulbosa*, crescent-shaped, bright end-wall thickenings (arrowed)

Fig. 121: *Chondria bulbosa*

Fig. 122, 123: *Chondria angustissima*.
Left: partial cross section, central thread (*c fil*), pericentral cells (*I-V*)
Right: plants on a leaf of a seagrass

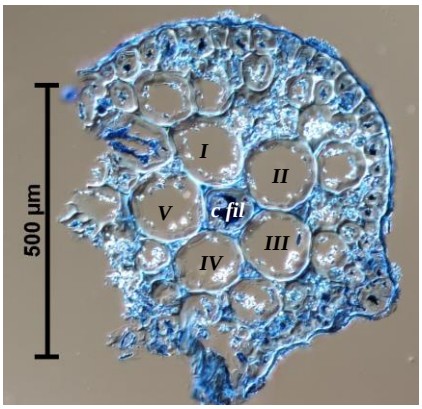


Fig. 124: *Hypnea ramentacea*, "shepherds-crook" tips and pointed short side branches

Fig. 125: *Hypnea valentiae*, plant with numerous short, spines

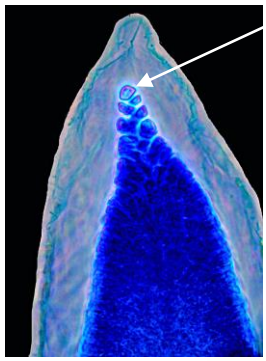


Fig. 127: *Hypnea valentiae*, prominent single tip cell (arrowed)

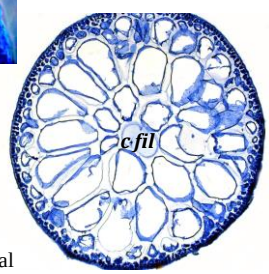


Fig. 126: *Hypnea filiformis*, cross section, central thread (c fil)

28a. branch tips *dimpled* with a pit often containing a tuft of hairs or a single sunken tip-cell.
..... 29.

28b. branch tips rounded, without a pit
……;…… 30.

29a. cross sections of ***young*** branches show a prominent central thread ringed by **5** large (pericentral) cells. Bright microscopic inner cell wall thickenings are common. Figs 126-134.
…. *Chondria* (in part) *and Husseya* spp
See "Pictured Keys: *Chondria* and *Husseya*"
Family: Rhodomelaceae
Family: Rhodomelaceae, Tribe: Chondrieae

29b. the **4** pericentral cells that ring a central thread in cross section of ***young*** branches are quickly obscured by additional equal-sized cells. Bright microscopic inner cell wall thickenings are uncommon. Figs 133-145.
..... *Laurencia* and *Chondrophycus*
See "pictured key to *Laurencia and Chondrophycus*"
Family: Rhodomelaceae, Tribe: Laurencieae

Fig. 128 *Chondria arcuata*

Fig. 129: *Chondria arcuata*. cross section of a young branch

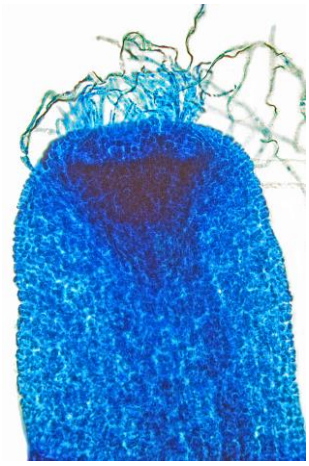


Fig. 130: *Chondria arcuata*, microscopic view of hairs emerging from the dimpled tip

Fig. 131: *Chondria curdieana*. Right: bright inner cell wall thickenings seen in lengthwise view

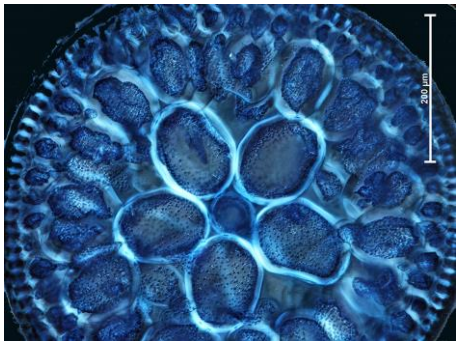


Fig. 132: *Husseya rubra*. Cross section of a ***young branch***, 5 prominent pericentral cells surrounding a central thread

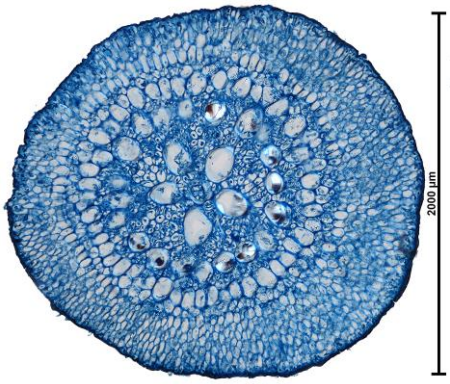


Fig. 133: *Husseya rubra*. Cross section of a ***mature branch,*** additional ring of large cells

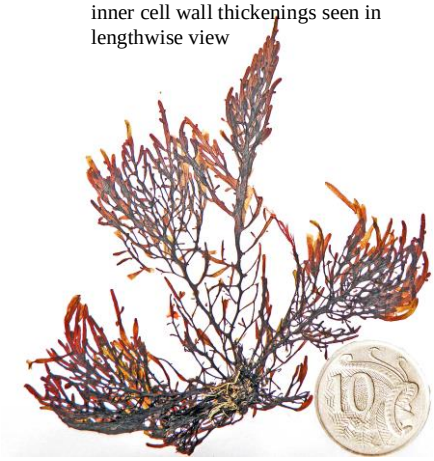


Fig. 134: *Husseya rubra*

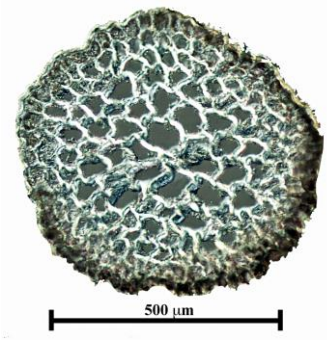


Fig. 135: *Laurencia filiformis*, cross section, indistinct central thread and equally indistinct 4 large, pericentral cells

Fig. 136 *Laurencia aldingensis*

Fig. 137: *Laurencia tasmanica*, short side branches ending in hair tufts emerging from pits

Figs 138, 139 *Laurencia arbuscula*.
Above: bunches of fertile branches.
Right: characteristic plant shape

Fig. 141: Left:
Laurencia forsteri on a leaf blade of seagrass

Fig. 140 *Laurencia heteroclada* (formerly *L. filiformis* var. *heteroclada* in the Flora)

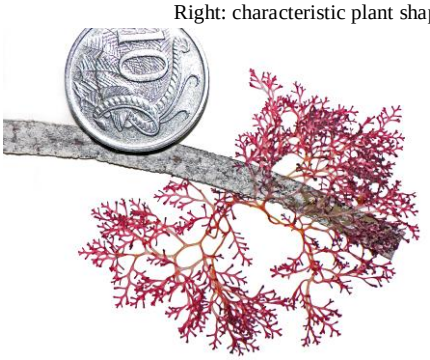


Fig. 142: Right:
surface view, cells with bright red bodies (*corps en cerise*) found only in fresh specimens of the genus *Laurencia*

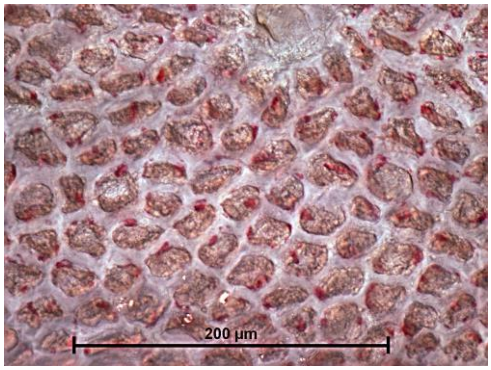


Fig. 143: *Chondrophycus brandenii*

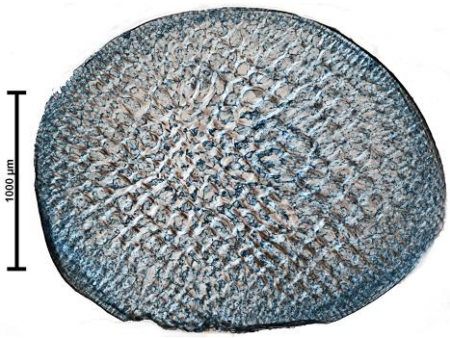


Fig. 144: *Chondrophycus brandenii*. cross section, central thread and pericentral cells obliterated by additional cells

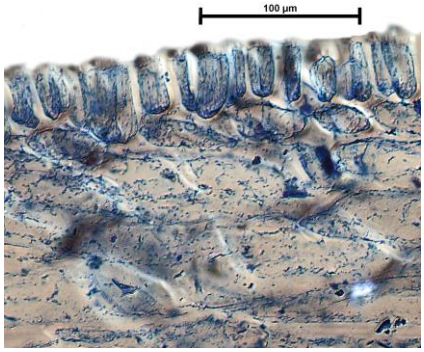


Fig. 145: *Chondrophycus cruciatus* cross section, of the outer cells; fence-like (palisade) cells characteristic of the genus

30a. branch core centres of small cells or with extremely fine threads ..... 31.

30b. branch cores of large, equal-sided cells in cross-sectional view, grading to small cells in the outer layer (cortex) ..... 32.

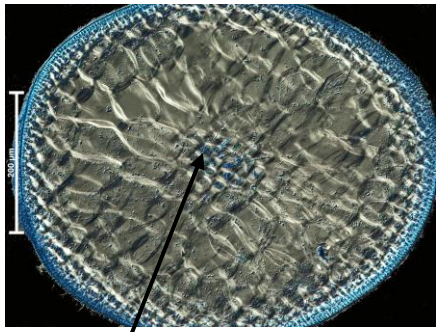
31a. plants generally small (< 100 mm tall), often grow on seagrass stems; branch cores with a central mass of small cells (actually, threads when seen in longitudinal view). Figs 146-148. ..... *Dicranema* 2 spp

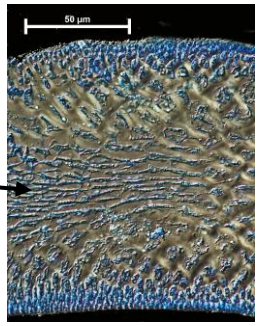
Go to "Southern Australian Groups at a glance: Dicranemataceae

31b. plants usually larger, core cells thick-walled, wrapped in cobweb-like, extremely fine threads. Figs 149-151. (next page) *Mychodea* 11 spp

Go to "Southern Australian Groups at a glance: Mychodea"

Fig. 146: *Dicranema revolutum* on a seagrass stem





Figs 147, 148: *Dicranema cinccinalis*, cross section (upper) and lengthwise section (lower), central small mass of threads (arrowed)

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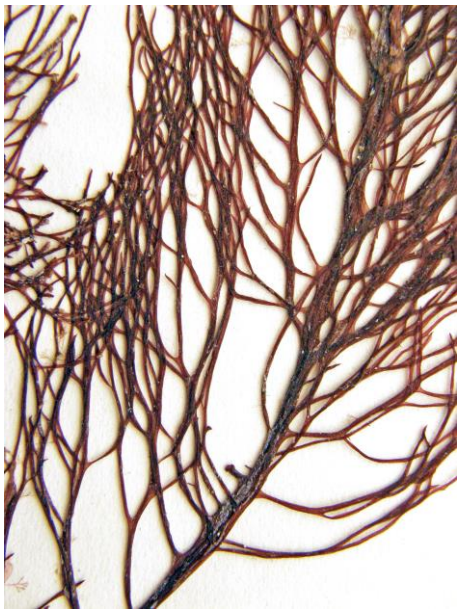
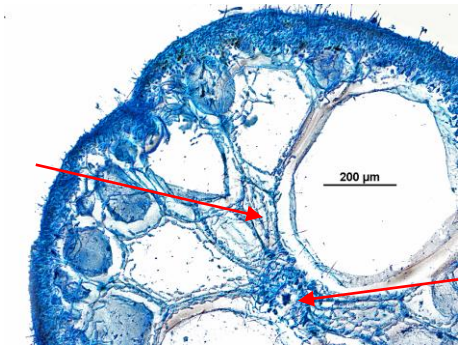


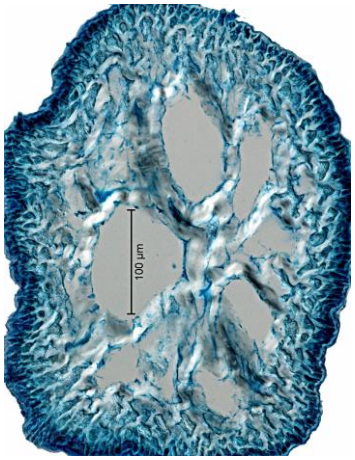


Figs 149, 150: *Mychodea carnosa*
Left: branching pattern
Above: part of a cross section with extremely fine threads (arrowed) in the centre and also ringing the large, equal-sized cells

Fig. 151: *Mychodea pusilla*, (right) on seagrass stems could be mistaken for *Dicranema*

32a. plants tall, wiry or hair-like or with long, whip-like, cylindrical main branches (axes), forked widely apart. Spores when present occur in a pyramidal stack of 4 (tetrahedral). Figs 152-158.
..... *Gracilaria* in part, or *Gracilariopsis*.
separated on reproductive features
See "Southern Australian Groups at a glance: Gracilariaceae"

32b. plants not as above, regularly or densely forked, axes cylindrical or flattened. Spores if present are tetrahedrally divided ***or*** in a linear stack of 4 (zonate)
..... 33.



Figs 152-154: *Gracilaria chilensis*.
Left: whole plant.
Centre: single branch with small, protruding female structures
Right: cross section, large inner cells grading to small outer ones

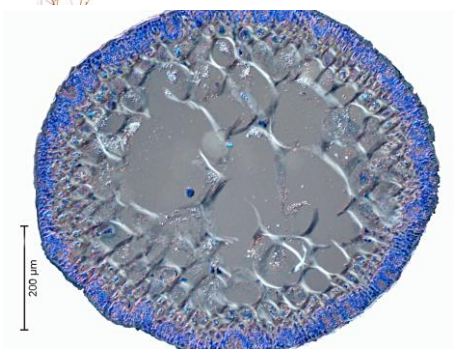


Fig. 155-157: *Gracilaria secundata*
Above, left: whole plants
Above, centre: detail of 1-sided branching
Left: cross section, large inner cells grading to small outer ones

Fig. 158: *Gracilariopsis lemaneiformis*
hair-like branches

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33a. branches flattened, branching in one plane ..... 34.
33b. branches cylindrical; wiry, whip- or hair-like, or thin and densely branched radially, irregularly or on one side ..... 37.

34a. tips suddenly ending in spine-like points. Figs 159-161. ..... *Gracilaria preissiana*
See "Southern Australian Groups at a glance: Gracilariaceae"

34b. tips rounded or conical ..... 35.

35a. surface layers of small cells in short chains; spores in pustules on the surface of branches ..... 36.
35b. spores scattered, imbedded in branches ..... 37.

36a. branches thin; plants densely branched near tips (although this may be a response due to grazing). ?Restricted to SE Australian waters. Figs 162-164. ..... *Ahnfeltiopsis humilis*
Family: Phyllophoraceae
36b. branches thicker, leathery, regularly and densely forked; distributed near ports, an introduced species. Figs 165-169. .....**Gymnogongrus crenulatus*
Family: Phyllophoraceae

Figs 159, 160: *Gracilaria preissiana*

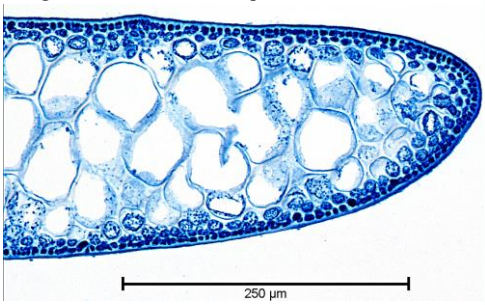
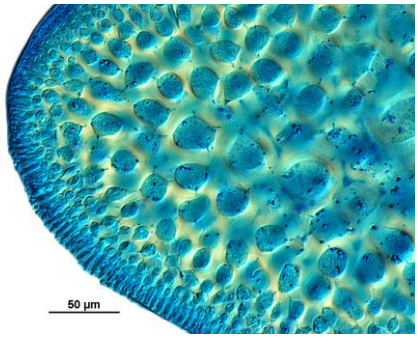
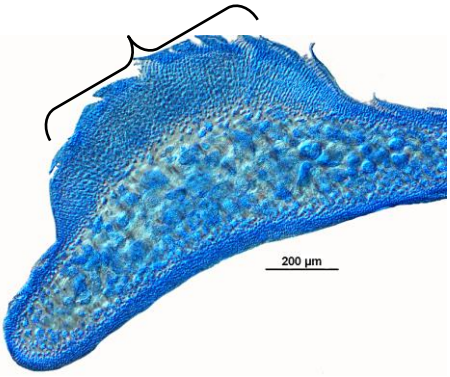


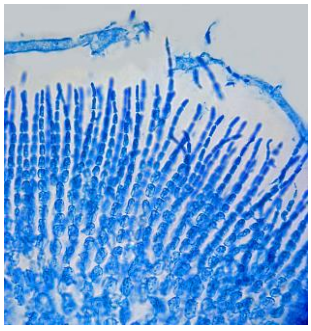
Fig. 161: *Gracilaria preissiana*
Partial cross section

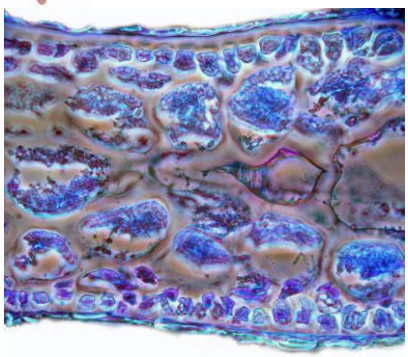
Fig. 162: *Ahnfeltiopsis humilis*





Figs 163, 164 *Ahnfeltiopsis humilis*
Above: cross section, blade edge
Right: cross section through a pustule (bracketed) with long chains of spores





Figs 165-169: *Gymnogongrus crenulatus*
Upper, left: magnified branches with sporangial pustules
Centre: whole plants
Upper, right: cross section through a sporangial pustule, detail of long chains of spores
Left:: section through a sporangial pustule
Right: portion of a blade in cross section

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37a. branches thin, ≈ 1 mm wide ..... 38.
37b. branches > 1 mm wide, some leathery (rattle when dry and beaten together), tips rounded, usually with a ***dark cap***. Figs 183-189 (next two pages).
..... *Melanthalia* 3 spp
smaller species have cylindrical branches, *M. obtusata* has slightly flattened branches
See "Southern Australian Groups at a glance: Gracilariaceae"

38a. branches flattened, ≈ 1 mm wide, regularly forked, spores in linear stacks of 4 (zonate); lengthwise sections show elongate core cells Figs 170-172.
..... *Trematocarpus affinis*
Family: Dicranemataceae

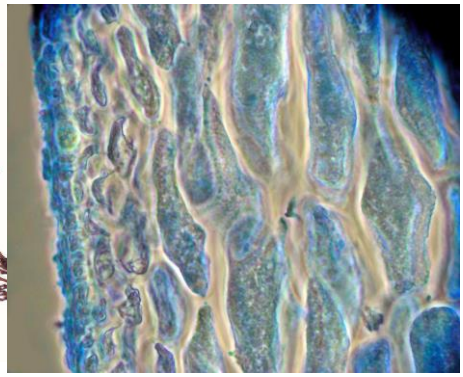
38b. branches cylindrical, < 1 mm wide
..... 39.

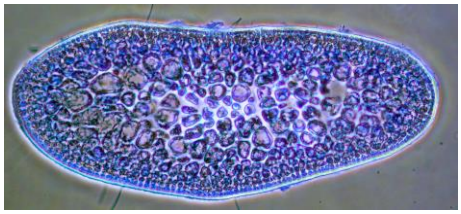
39a. branching irregular, core cells are roughly equal-sided, large, grading to smaller cells in outer layers; spores scattered and embedded in outer layers, occur in a pyramidal stack of 4 (tetrahedral); .. Figs 173-175.
..... *Gracilaria cliftonii*
(as *G. ramulosa* in the Marine Benthic Flora)
See "Southern Australian Groups at a glance: Gracilariaceae"

39b. branching regularly forked, forming roughly fan-shaped bunches; cross sections of branches show outermost layers of small cells sometimes in short chains..... 40.

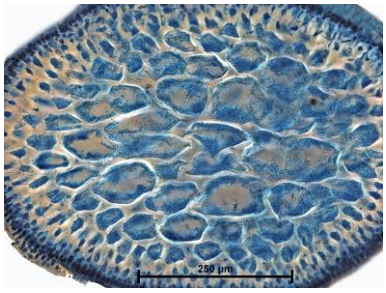
40a. distance between forks in the branches is short: spores occur in pustules developing as surface outgrowths on female plants after sexual reproduction has occurred; spores if present in a cross-shaped pattern of 4. Figs 176-178.
.....*Gymnogongrus griffithsieae*
Family: Phyllophoraceae

40b. large distances between forks: longitudinal sections show elongate cells in core centres; spores in linear stacks of 4 (zonate), scattered in the outer layers of clumps of short, terminal branches. Figs 179-183 (next page)
..... *Trematocarpus concinnus*
Family: Dicranemataceae

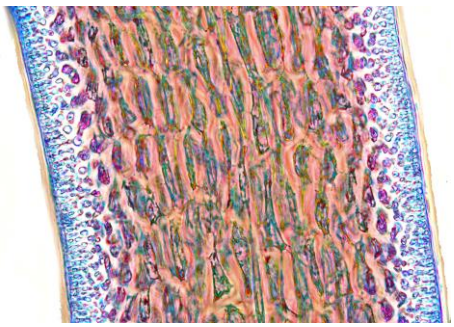




Figs 170-172: *Trematocarpus affinis*
Above, left: whole plant
Above: lengthwise section, core cells elongate
Left: cross section, central patch of smaller core cells



Figs 173-175: *Gracilaria cliftonii*
Above: whole plant.
Above, right: detail of tips with protruding female structures (cystocarps)
Right: cross section



Figs 176-178: *Gymnogongrus griffithsieae*
Left: lengthwise section through fertile branches; button-like outgrowths that produce spores
Right, above: lengthwise section; elongate cells in core centre
Right, below: whole plant

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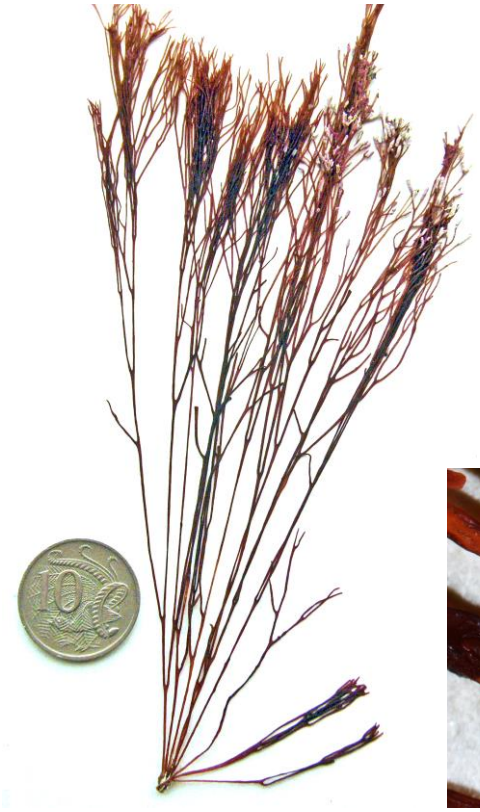
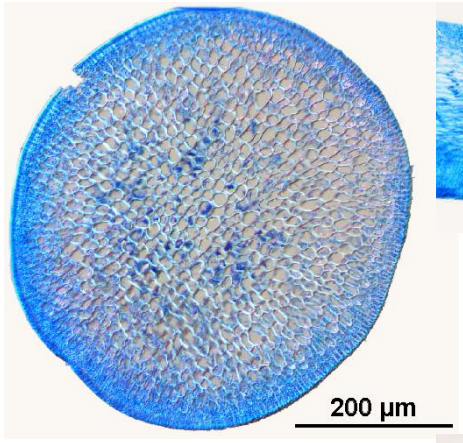
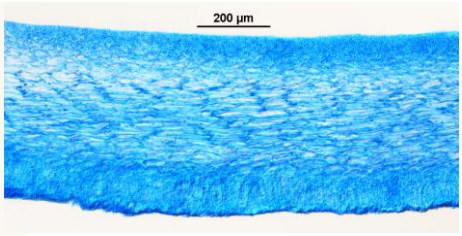
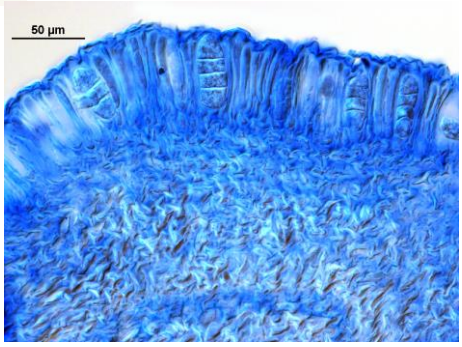






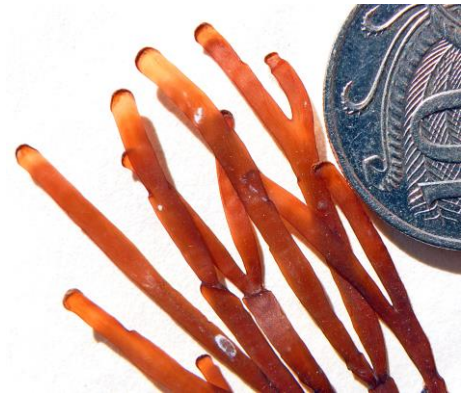


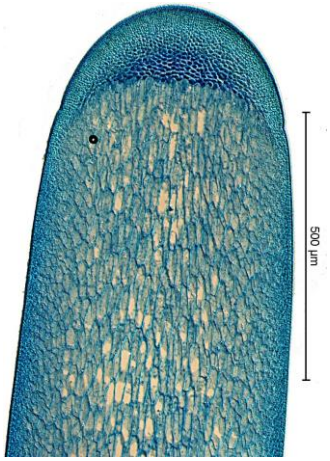
Figs 179-183: *Trematocarpus concinnus*
Above: whole plant

Above: cross section
Below: clumps of short, terminal fertile branches
(Photo: C Ricci)

Above: lengthwise section; elongate core cells
Below: outer layer of short, fertile branches with zonate spores

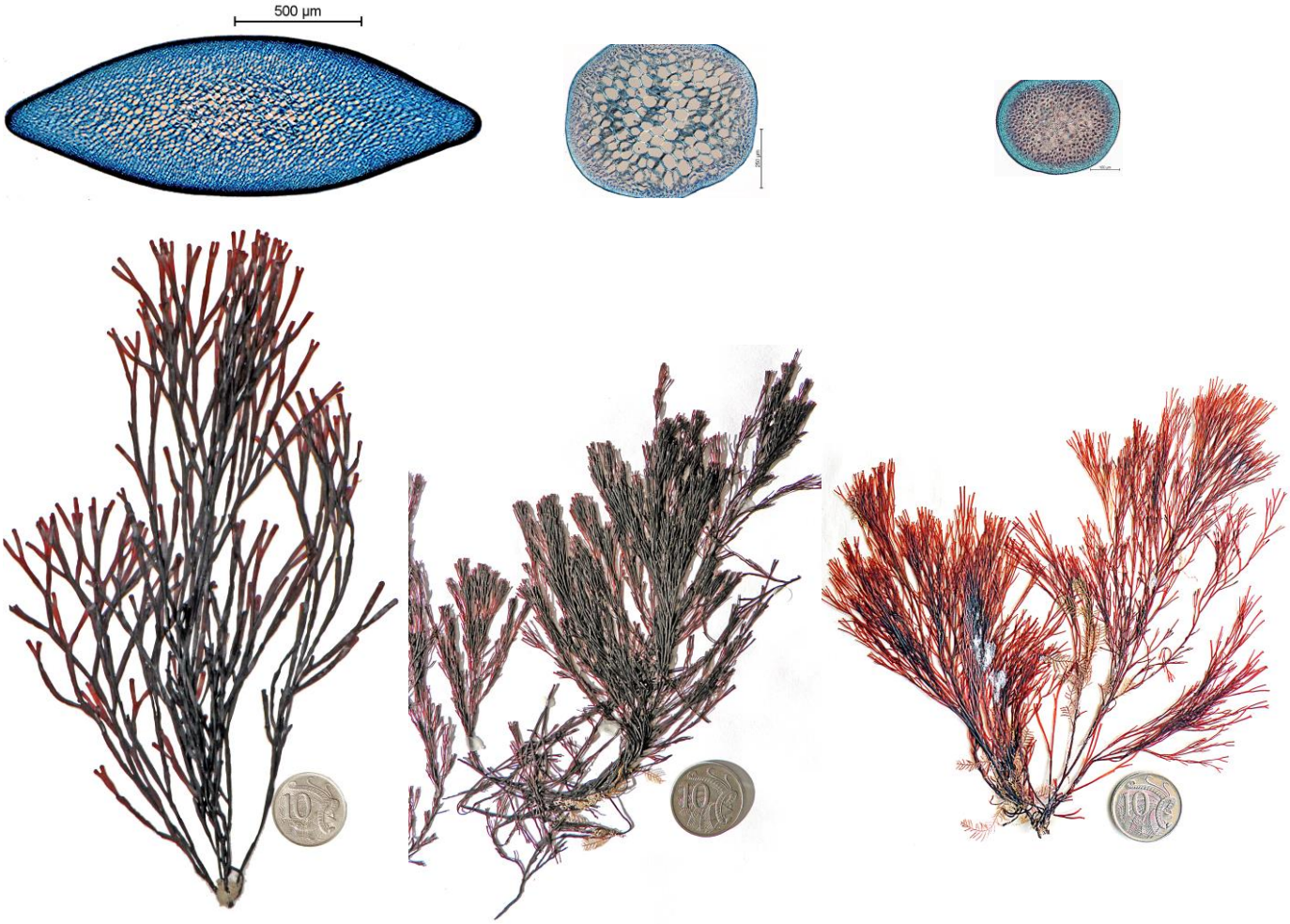
Fig. 184: *Melanthalia* meadows in the upper sub-tidal at Pt Elliot, SA





Figs 185, 186: *Melanthalia obtusata*
Above: tips, with darkened caps

Right: lengthwise section of a branch tip



Figs 187-189: *Melanthalia* spp, whole plants and cross sections of branches arranged in scale from largest to smallest species
Left: *M obtusata* Centre: *M. concinna* Right: *M. abscissa*

SUMMARY
Genera/species included in this key:

Acrotylus australis	*Heterocladia umbellifera*
Adelophycus corneus	*Husseya rubra*
Ahnfeltiopsis humilis	*Hypnea* spp
Antrocentrum nigrescens	*Kraftia dichotoma*
Areschougia spp	*Laurencia* spp
Capreolia implexa	*Liagora* spp
Chiracantha arborea	*Lomentaria monochlamydea*
Chondrophycus spp	*Lomentaria* spp
Chondria spp	*Melanema dumosa*
Cladurus elatus	*Melanthalia abscissa*
Delisea hypneoides	*Melanthalia concinna*
Dicranema spp	*Melanthalia obtusata*
Erythroclonium angustatum	*Mychodea* spp
Gelidium spp	*Nizymenia* spp
Gigartina brachiata	*Polyopes constrictus*
Gonatogenia subulata	*Polyopes tenuis*
Helminthocladia spp	*Rhabdonia coccinea*
Gracilaria cliftonii	*Sarcothalia insidiosa*
Gracilaria preissiana	*Scinaia australis*
Gracilariopsis spp	*Scinaia tsinglanensis*
Gymnogongrus crenulatus	*Semnocarpa* spp
Gymnogongrus griffithsieae	*Solieria* spp
Helminthora spp	*Trematocarpus concinnus*
	Tsengia feredayae

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